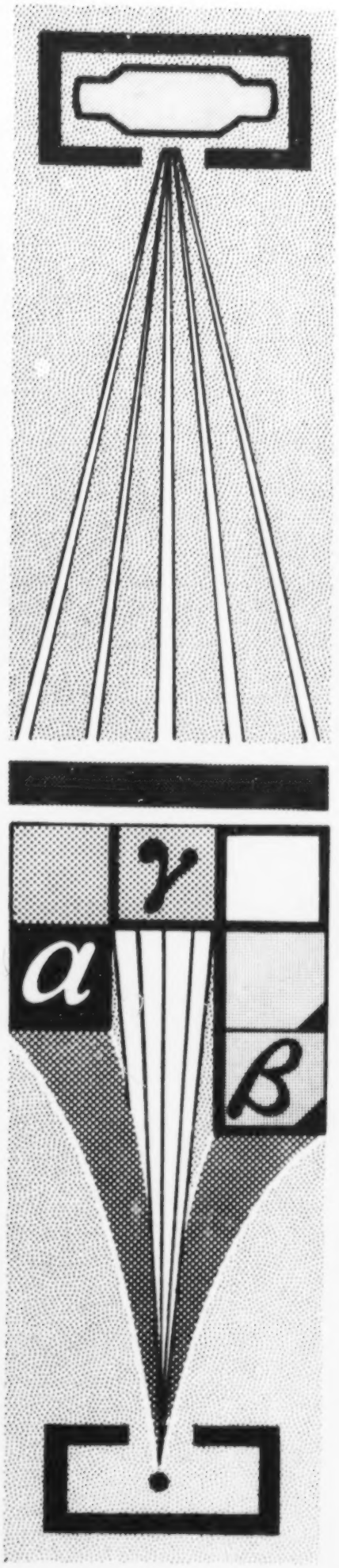

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MEDICAL SURPAK SUMMARY REPORT

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Consumer Protection and Environmental Health Service
Environmental Control Administration

MORP 68-4

MEDICAL SURPAK SUMMARY REPORT

prepared by

X-ray Section

Medical and Occupational Radiation Program

SEPTEMBER 1968

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Control Administration
National Center for Radiological Health
Rockville, Maryland 20852

MEDICAL AND OCCUPATIONAL RADIATION PROGRAM

Technical Reports

The following technical reports issued by the Medical and Occupational Radiation Program are available through the Office of Information, National Center for Radiological Health, Public Health Service, U.S. Department of Health, Education, and Welfare, Rockville, Maryland 20852:

PHS No. 1559	Physical Survey Manual Dental X-ray
PHS No. 1582	Radiation Protection Survey Report Manual
PHS No. 1633	KWIC Index to the Journal of the Health Physics Society (1958-1966)
PHS No. 1698	Radium and the Physician
PHS No. 1831	KWIC Index to the Journal of Nuclear Medicine (1960-1967)
PHS No. 999-RH-29	Tritium Contamination in Particle Accelerator Operation
PHS No. 999-RH-30	Reduction of Radiation Exposure in Nuclear Medicine
MORP 67-1	X-ray Emission from Shunt Regulator Tubes for Color Television Receivers
MORP 67-2	Radium Disposal Project
MORP 67-3	Radium Source Integrity Testing Progress Report
MORP 67-4	Design of Interlocked Radium Shipping Container
MORP 67-5	A Summary Report on X-ray Diffraction Equipment
MORP 67-6	Georgia Radium Management Project. . . Phase II
MORP 67-7	Decontamination Study of a Family Dwelling Formerly Used for Radium Processing (Preliminary Copy)
MORP 68-1	A Collection of Radium Leak Test Articles
MORP 68-2	Recommendations for the Safe Operation of Particle Accelerators
MORP 68-3	A System for the Registration of Radiation Sources
MORP 68-4	Medical Surpak Summary Report
MORP 68-5	The Use of Radium in Consumer Products (In preparation)
MORP 68-6	Preliminary Results of 5263 X-ray Protection Surveys of Facilities with Medical X-ray Equipment (1962-1967)
MORP 68-7	A Review and Analysis of Radium Incidents
MORP 68-8	Dental X-ray Teaching and Training Replica
MORP 68-9	Development and Evaluation of an Automatic Collimator for Medical Diagnostic X-ray Machines
MORP 68-10	Survey of the Use of Radionuclides in Medicine: Preliminary Report

FOREWORD

The National Center for Radiological Health conducts a national program for the prevention and control of radiological hazards to public health through (1) surveillance activities, (2) research and development programs, (3) technical assistance to governmental and other organizations, (4) technical training programs, (5) development of criteria and codes, (6) administration of grants, (7) consultation on international programs, and (8) public information and education activities.

The Medical and Occupational Radiation Program is the component of the Center which deals with reduction of unnecessary radiation exposure of patients, workers, and others incidentally exposed by the use of X-rays, radioactive materials, radiopharmaceuticals, and particle accelerators.

The Center publishes its findings in Radiological Health Data and Reports (a monthly publication), the Environmental Health Series, Public Health Service numbered reports, appropriate scientific journals, and Program and Branch technical reports.

The technical reports of the Medical and Occupational Radiation Program (MORP) allow comprehensive and rapid reporting of the results of inhouse and contractor projects. The reports are distributed to State and local radiological health program personnel, Center technical staff, Center advisory committee members, University radiation safety officers, libraries and information services, industry, hospitals, laboratories, schools, the press, and other interested individuals. These reports are included in the collections of the Library of Congress and the Clearinghouse for Federal Scientific and Technical Information.

I encourage the readers of these reports to inform the Center of any omissions or errors. Your additional comments or requests for further information are also solicited.

James G. Terrill, Jr.
Center Director

PREFACE

This report documents the development and field testing of the Medical Surpak, a mailable survey packet designed to be sent to medical X-ray machine users, exposed by them, and returned to a health agency for processing and evaluation of possible radiation hazards. The Medical Surpak is similar in concept to the Dental Surpak (MORP Report 68-11, in preparation), which has been widely used by State radiological health agencies. However, because of the difficulty in designing a survey packet to accommodate the great variety of medical X-ray machine configurations and procedures, and because of the cost of such a system, the Medical Surpak has not been accepted by health agencies for routine surveys.

The information presented here indicates the potential value of the Medical Surpak, as well as the problems inherent in its design and use.

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John C. Villforth
Chief, Medical and Occupational
Radiation Program

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Program

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INTRODUCTION

In recent years the increased emphasis on radiation protection surveys has generated the need for more sophisticated survey methodology. To help meet this need, the Medical and Occupational Radiation Program of the National Center for Radiological Health developed a compact radiation protection survey packet, called the Surpak. This packet can be mailed to X-ray machine users by a health agency, exposed by the machine user, and mailed back to the health agency for processing and evaluation. When exposed by an X-ray machine as described in the accompanying instructions, the packet enables measurement of certain critical machine characteristics that could formerly be obtained only by on-site inspection of the equipment.

In 1960 the Center developed its first Surpak; this was later used in 40 States to survey more than 55,000 dental X-ray machines. The Dental Surpak, containing an 8- by 10-inch film and a step-wedge filter, provides information on machine factors such as (1) size and symmetry of the beam, (2) total filtration, (3) Roentgen output, and (4) half-value layer (HVL).

Later efforts were directed toward development of a Surpak for use in surveying medical X-ray machines. In June 1964, at the annual Health Physics Society meeting, the National Center for Radiological Health presented a preliminary report on the design of a Medical Surpak (1-3). This design was later modified with additional film components and was used in the 1964 Public Health Service Population Exposure Study (4,5). Because of storage problems encountered by State health departments in limited field trials of the original Medical Surpak design, the Surpak was modified to be more compact. This report describes the final design of the Medical Surpak, provides details of its use, and evaluates results of the field tests.

DESIGN OF MEDICAL SURPAK

The Medical Surpak was designed to measure the following parameters: (1) X-ray beam size and symmetry, (2) half-value layer, (3) total filtration, (4) Roentgen output and exposure rate, (5) fluoroscopic tube target-to-panel top distance, and (6) beam collimation and attenuation through the fluorescent screen. Each Surpak contains three individual packets, labeled CHEST, EXTREMITY, AND FLUOROSCOPE. The first two are designed to estimate the radiation exposure, beam size, half-value layer, and total filtration used in routine radiography of an adult chest and an adult hand, respectively. The third packet is used to estimate HVL and total filtration and to measure the distance from tube target to the panel top and the exposure rate at the panel top of a fluoroscope when the kVp and mA are set for an adult abdomen. This

packet also determines the attenuation and collimation of the useful beam when the shutters are opened to maximum width with the fluorescent screen positioned 15 inches from the panel top.

The components of the Medical Surpak are shown in Figure 1. Each packet includes 16 mm strips of X-ray film to monitor beam size. The chest packet contains two 48-inch film strips; the other packets each contain two 24-inch strips. Half-value layer, total filtration, and Roentgen output are derived from X-ray dosimetry film packets. Attached to each of these packets is a small aluminum discriminating filter, 2 mm thick. In the chest and extremity portions of the Surpak, the dosimetry film packets are attached to 3- by 3-inch plastic crosses which include several coding devices (Figure 2). In use, the 16 mm film strips are inserted into the chest and extremity crosses; these are then centered on the cassette holder or in the position of the film cassette itself, and routine exposures are made. In the fluoroscopic packet, the dosimeter is attached to a steel clip which holds a 5- by 7-inch X-ray film upright. In use, the steel clip containing the 5- by 7-inch film is placed on the panel top; the film strips are inserted into the 3- by 3-inch plastic cross centered on the operator side of the fluorescent screen; the screen is positioned 15 inches from the panel top above the 5- by 7-inch film (Figure 3); and an exposure is made.

All of the components fit into a 26- by 3 1/4- by 1 3/4-inch returnable cardboard mailing box. A dosimeter film is attached to the inside of each mailing box to serve as a control for the films in that box. Also included are instruction sheets (Appendix 1) and a data sheet for recording exposure parameters (Appendix 2).

If information as to the type of X-ray unit within each facility (radiographic only, fluoroscopic only, or combination) is known prior to the distribution of Surpaks, then only those components relative to the machine type have to be mailed to the facility; for example, a physician who possess only a radiographic unit would be sent only the chest and extremity components.

INTERPRETATION

Half-value layer, total filtration, and Roentgen output are estimated from the net densities of the dosimeter films. The open beam density and the density under the two millimeter aluminum discriminator are read on a densitometer. Net density values are obtained by subtracting the density of the monitor film enclosed in each Surpak mailing box from the gross densities of the dosimeter films from that box. Relative exposure values R_0 and R_1 corresponding to exposures in the open beam and under the aluminum discriminator respectively are then derived from the net density values using a characteristic curve of film density versus log relative exposure.

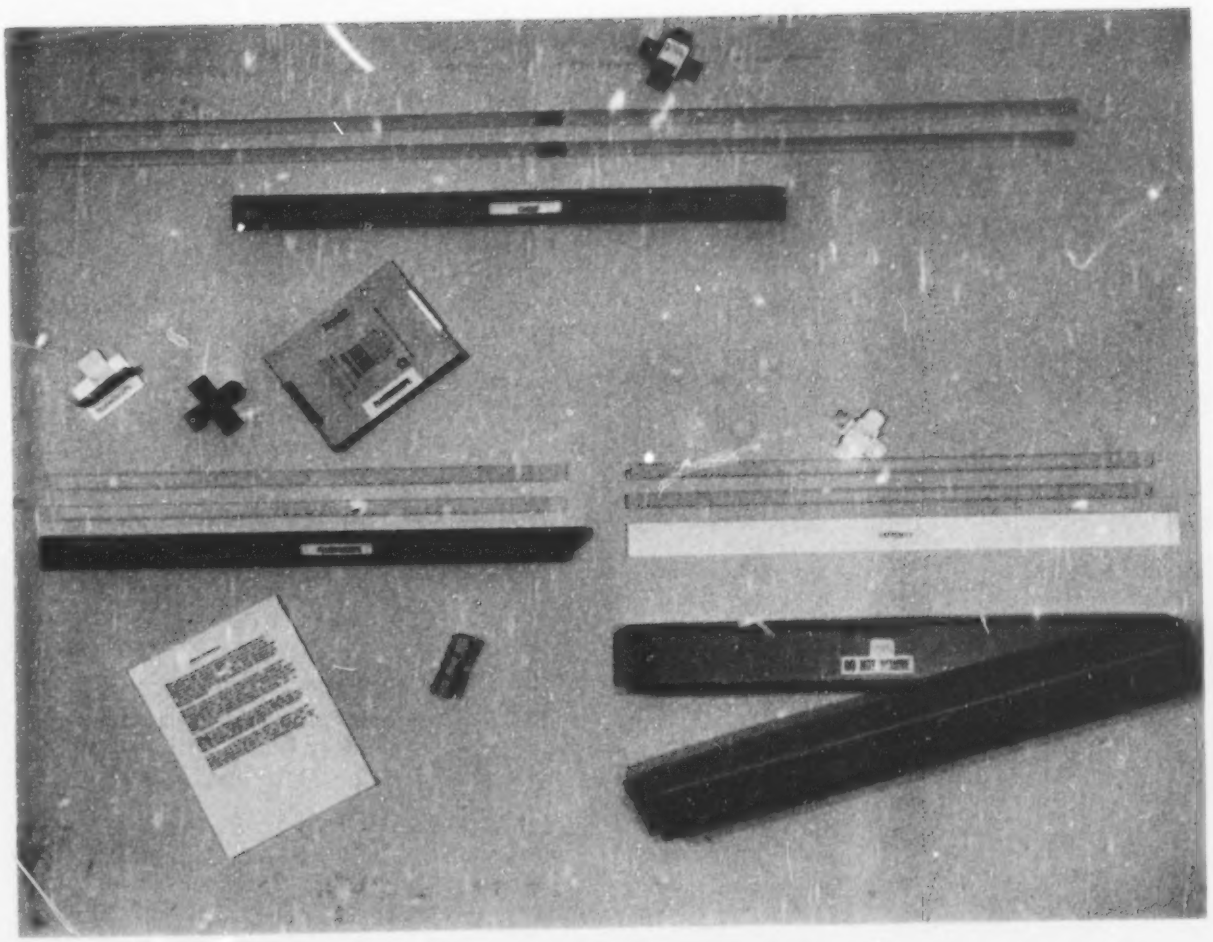

Figure 1. Components of Medical Surpak

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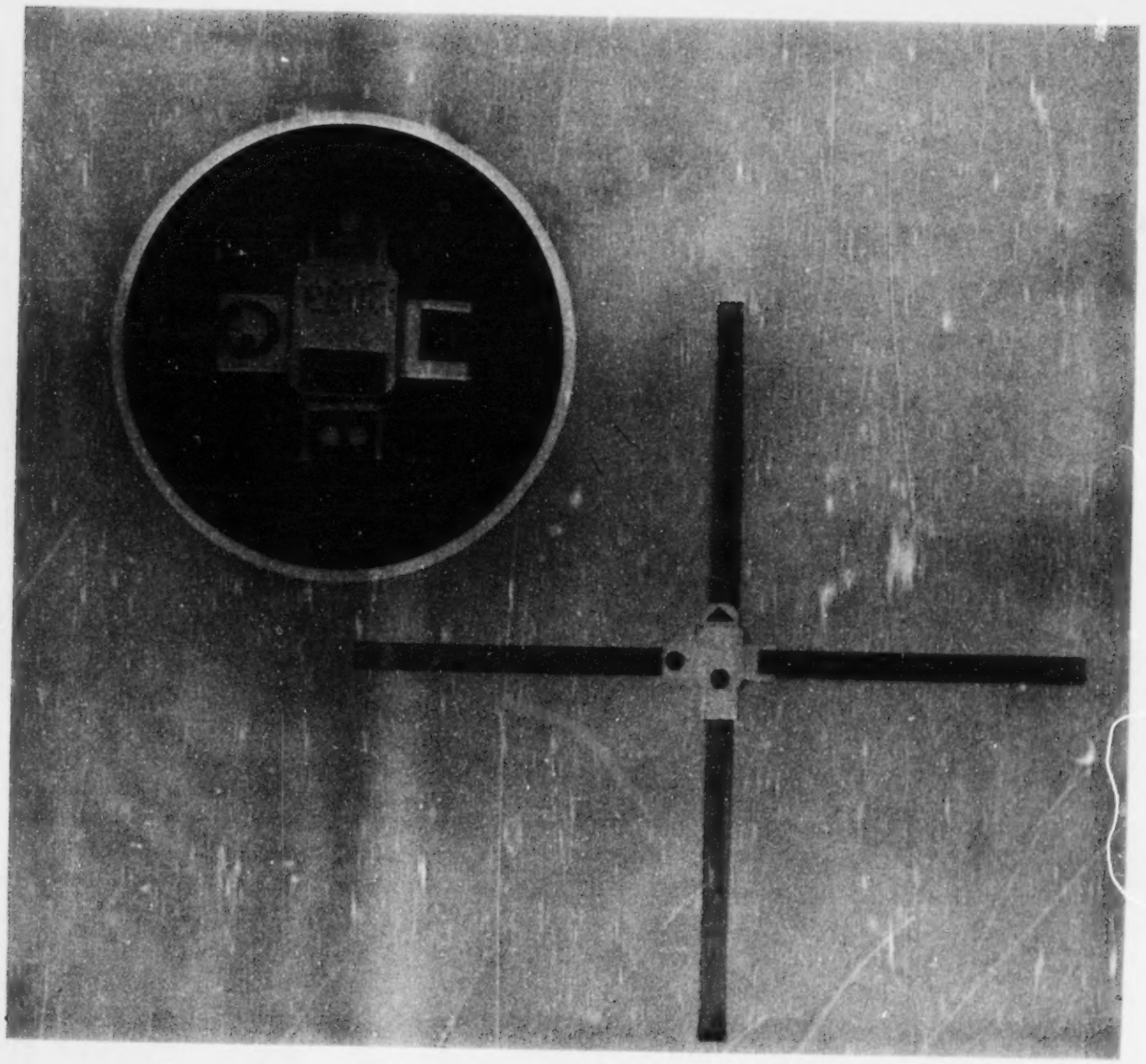

Figure 2. Assembled extremity film packet (inset: plastic chest cross with dosimeter film and coding devices)

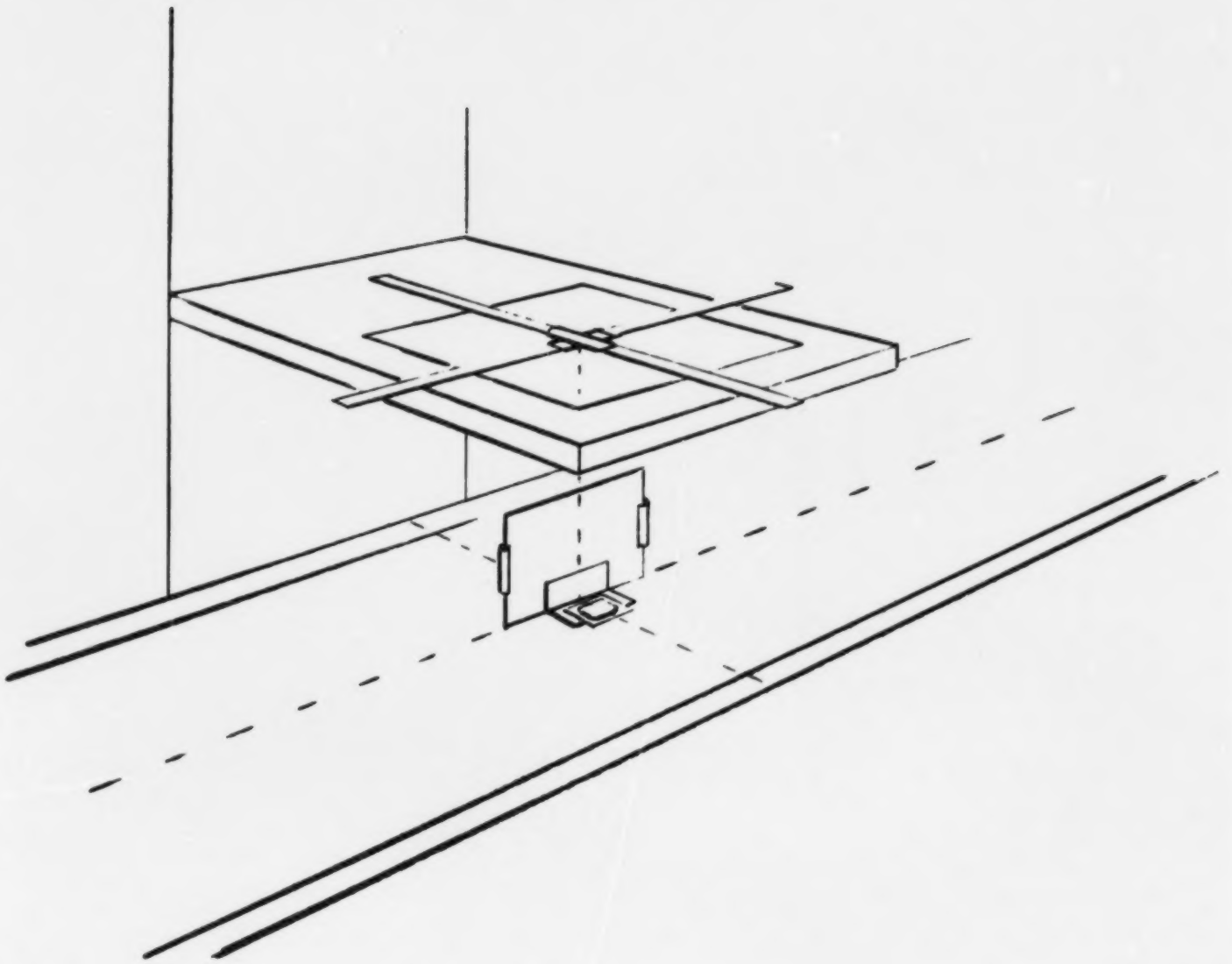

Figure 3. Fluoroscopic packet in position for survey of a horizontal fluoroscope

To estimate the half-value layer from the Medical Surpak dosimeter films, a ratio of R_1 to R_0 is used. The derived ratio is read from calibration curves of half-value layer versus relative exposure ratio (R_1/R_0). Total filtration estimates are based upon the derived half-value layer figures. A family of calibration curves of filtration versus half-value layer was derived with the kVp held constant at 40, 50, 60, 70, 80, 90, and 100 kVp. Total filtration is estimated by reading the filtration corresponding to the derived half-value layer from the curve made at the reported kVp (6). The kVp used to estimate beam quality is subject to both reporting error and to variability arising from level of tube current and other physical factors.

Exposure information is derived with the aid of a calibration graph of correction factors versus relative exposure ratio (Figure 4). The relative film exposure in the open beam multiplied by the correction factor corresponding to the relative exposure ratio of that film gives the exposure in milliroentgens.

The extremity and chest field sizes are read from the film strips on a view box constructed in the form of a cross (Figure 5). Positioning the strips in the same manner for reading as for exposure allows direct measurement of the true beam size.

The fluoroscopic film strips are also read on the cross-shaped view box. Darkening within 15 to 18 inches from the center of these strips indicates direct beam exposure through the lead glass on the fluorescent screen. Darkening of the outer edges of the strips indicates that the useful beam exceeds the periphery of the fluorescent screen.

The 5- by 7-inch fluoroscopic films are read by extrapolating along the edges of the shadow cast on the film by the steel film clip to obtain a point of intersection (Figure 6). The perpendicular distance from the bottom edge of the film to a parallel line through the point of intersection is the target-to-panel top distance.

COST

The total cost (materials and personnel) for a Medical Surpak survey program employing 100 Surpaks is estimated at $2023. This is approximately $20 per Surpak. In some programs, $2 of this cost may be deducted for reusable parts. The following is a cost breakdown for 100 Surpaks:

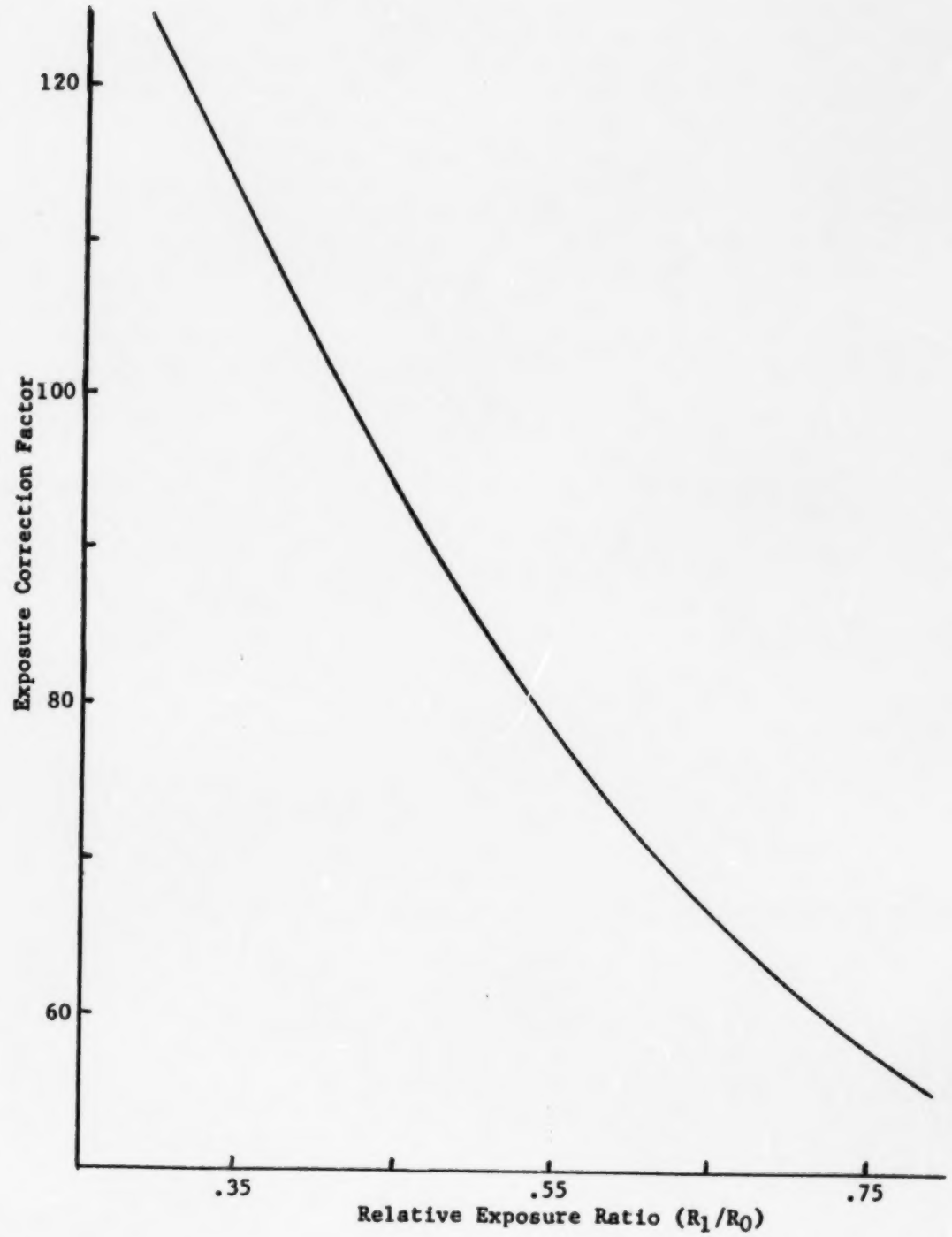

Figure 4. Medical Surpak interpretation graph - exposure correction factor vs. relative exposure ratio

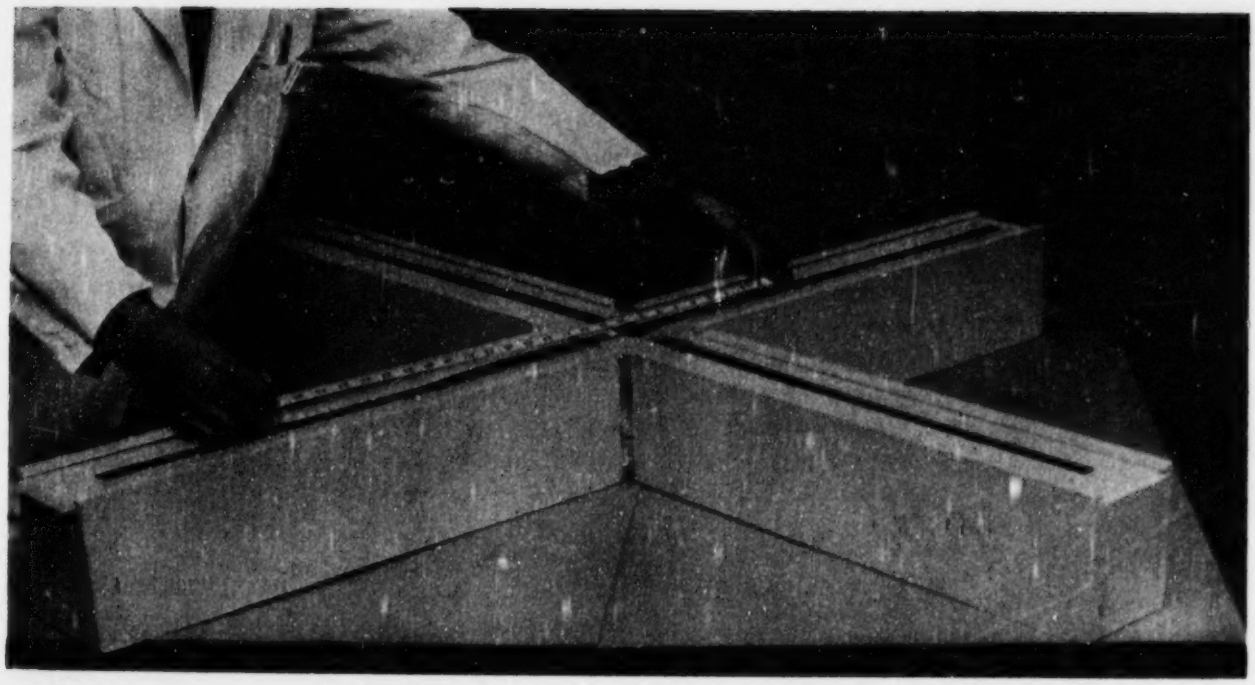

Figure 5. Reading exposed film strips on view box

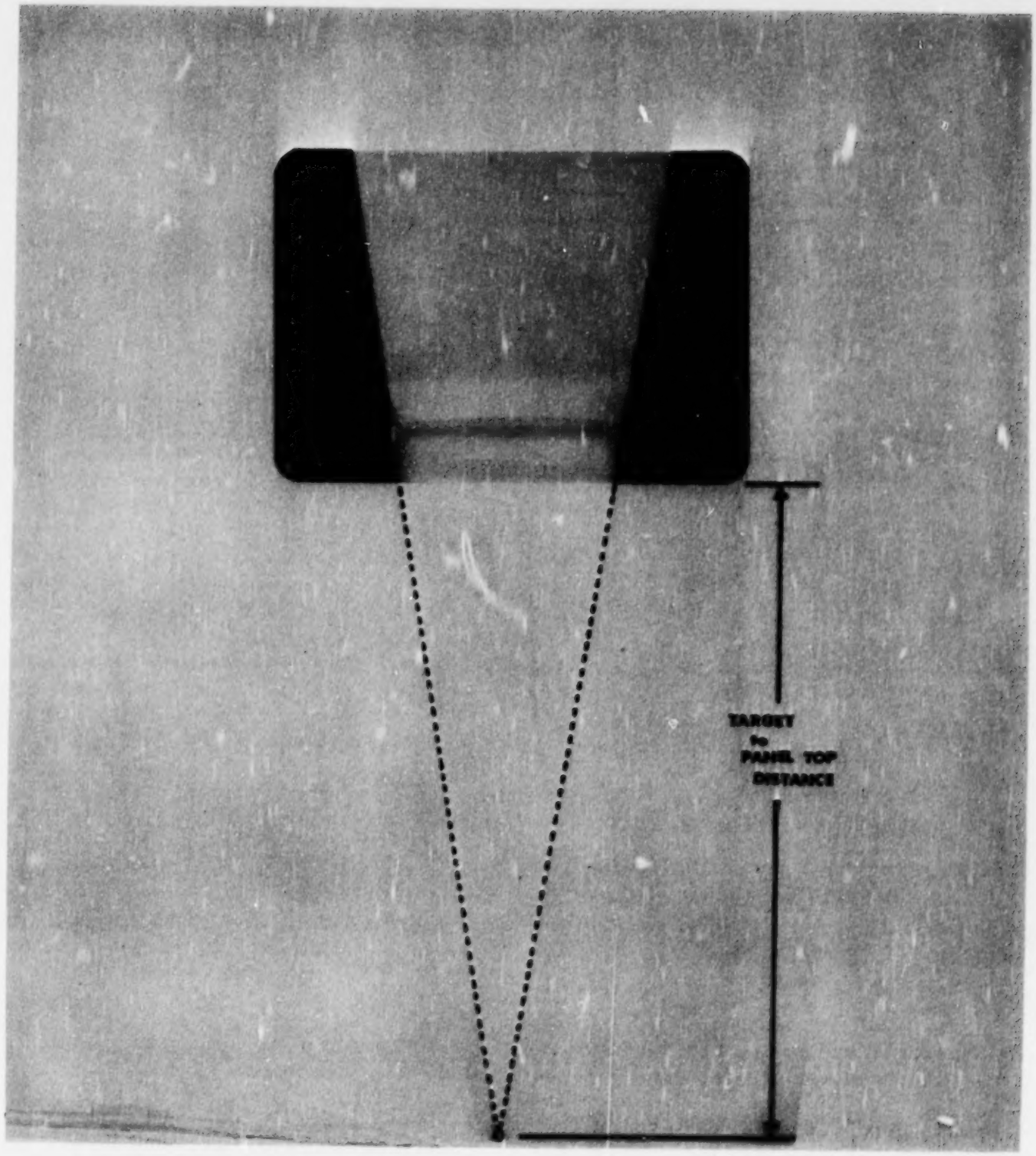

Figure 6. Measurement of target to panel top distance with 5- by 7-inch films

Materials	Costs
24" long, 16 mm X-ray film packets	$430.00
5-by 7-inch X-ray film packets	12.00
Dosimeter film packets	23.00
Steel film clips	80.00
Cardboard mailing boxes	60.00
Plastic crosses and envelopes	75.00
Postage	100.00
Miscellaneous	10.00
Total	$790.00

Personnel	Costs
Technician (Full time for 30 days @ $2.55/hr.)	$ 612.00
Assemble Surpaks (6 days)	
Process Surpak film (6 days)	
Interpret Surpak film (9 days)	
Expose, process, and read calibration films (9 days)	
Technical supervisor (1/4 time for 30 days @ $5.75/hr.)	$ 345.00
Clerk typist (1/2 time for 30 days @ $2.30/hr.)	$ 276.00
Total	$1233.00
GRAND TOTAL (Materials and Personnel)	$2023.00

FIELD TRIALS

The Medical Surpak was field tested in three independent trials. The first of these was a preliminary trial conducted in the State of Nevada. The objective of this trial was to conduct an initial evaluation of the Medical Surpak in a field setting in order to make the necessary procedural adjustments before sophisticated testing could be carried out. As a result of the Nevada test, the Surpak design was modified and a procedural flow pattern was established.

Further field testing of the Surpak was conducted to determine the following: the logistics involved in mass distribution and processing of the Surpak (Mississippi) (7), and the reliability (or degree of accuracy) of Surpak results when compared with measurements of the same parameters obtained during a physical survey (Rhode Island) (8).

Mississippi

The field trial to evaluate the Medical Surpak from a logistics standpoint was conducted in cooperation with the Mississippi State Board of Health. In this study the concern was with large scale distribution of the Surpak and the utilization of its components.

Participating facilities were selected at random from groups based on type of facility (i.e., private offices, hospitals, and medical clinics) and workload (i.e., greater or less than 50 exposures per month). An explanatory letter (Appendix 3) was sent to each selected facility. One week later, Surpaks appropriate to the type of X-ray unit registered were mailed, together with a second letter (Appendix 4). After one more week, a follow-up letter (Appendix 5) was sent to each facility that had not returned the Surpak. One week after this, the remaining non-respondents were contacted by telephone.

Of the 450 Surpaks distributed in Mississippi, 409 were returned for evaluation. Of these, 39 were totally unexposed and 370 were exposed in at least one phase.

1. Chest components

Of the 348 chest packets returned exposed, 70 dosimeter films could not be successfully evaluated; of these, 59 were exposed through the back of the packet. Half-value layers and radiation exposure estimates were made from 278 of the chest dosimeter films.

Estimates of total filtration were possible in 251 (72 percent) exposed chest components. The kVp used to expose the dosimeter was not included on 27 data sheets and therefore, total filtration could not be calculated.

That portion (the film strips) of the chest component necessary to make estimates of beam size was exposed in 348 cases. A total of 159 films or 46 percent were improperly exposed. In 59 cases the operator failed to expose the proper side of the

film, and therefore, in the case of rectangular beams, it was impossible to distinguish horizontal from vertical dimension of the beam. In 70 instances the operator did not unfold the film and extend it to the full 48-inch length and, therefore, it was not possible to measure the size of the beam beyond 24 inches. Other problems encountered were loss of orientation device, inability to match film strips, and over-exposures that caused the identification number to be obscured.

2. Extremity components

Exposures were made in 347 cases using the extremity component of the Surpak. As in the case of the chest packet, the most common fault resulting in the failure of the dosimeter portion of the extremity component was the exposure of the dosimeter from the back side. This occurred in 56 of the exposures. In addition, dosimeter information failed in seven other cases. Thus, estimates of half-value layer and Roentgen output could not be made for a total of 63 (18 percent) of the 347 exposed extremity packets.

Because of failure of the operator to provide kVp information, 28 additional dosimeters could not be evaluated to provide filtration information. This made a total of 91 dosimeters from which total filtration could not be successfully estimated.

3. Fluoroscopic components

Of the 231 fluoroscopic components distributed, 102 were returned exposed. In the dosimetric portion of the packet, 15 percent of the films did not supply sufficient information to make estimates of the half-value layer and radiation exposure rate at the table top. An additional seven films, for a total of 22 percent, were not usable for filtration estimates because kVp information was not provided.

Estimates of target-to-panel top distance were made in 83 percent of the exposed components. Over-exposure of the 5- by 7-inch film was a common cause for failure.

In conclusion, the results of the Mississippi field trial demonstrated that, although the distribution of the Surpak is relatively simple and efficient, the components are too often

improperly exposed by the operator, thus invalidating the Surpak's usefulness.

Rhode Island

The field trial to measure the reliability of the Surpak was carried out in the State of Rhode Island. The test was divided into two phases: exposure of a Surpak (Surpak I) by the owner or operator of the X-ray unit and exposure of a Surpak (Surpak II) by National Center for Radiological Health personnel on the same unit used to expose Surpak I and at the same exposure settings. A physical survey was also conducted at the time of the exposure of Surpak II, in order to obtain data to compare with Surpak I results.

Included in each Surpak II box were three lithium fluoride thermoluminescent dosimeter (TLD) capsules that provided exposure measurements to compare with the film results. Capsules labeled CHEST, EXTREMITY, and FLUOROSCOPE were exposed along with their respective dosimeter film counterparts.

One hundred and twenty-six of the 150 Surpaks used in Rhode Island were exposed in at least one phase--40 chest packets, 46 extremity packets, and 40 fluoroscopic packets. Ninety-one percent of the exposed chest packets, 85 percent of the exposed extremity packets, and 90 percent of the exposed fluoroscopic packets were readable.

In attempting to analyze the Rhode Island data, the physical survey measurements were used as the baseline, since these measurements were "known values." Surpak I measurements were compared with the physical survey measurements, since these exposures were made by an operator totally unfamiliar with the Surpak and thus simulated the actual conditions under which the Surpak is to be used.

Since half-value layer and Roentgen output were not determined in the physical surveys conducted on radiographic units, it was not possible to compare these measurements with Surpak results. Comparisons were made between the estimates of filtration obtained using Surpak I and those using Surpak II. However, no attempt was made to correlate the experimentally determined filtration values with the values determined during the physical survey.

Data derived from the Rhode Island field trial is presented below:

1. Half-value layer. From chest packets, the percentage of units having a HVL less than or equal to 2.4 mm aluminum was

68 percent and 72 percent for Surpaks I and II, respectively. In the case of the extremity packets, the percentages were 92 percent and 95 percent, respectively. Since half-value layer determinations were not included in the physical survey, a more accurate test of the ability of the Surpak to measure HVL was not possible.

2. Total filtration. Total filtration values less than or equal to 2.4 mm of aluminum were indicated in 51 percent and 56 percent of the properly exposed Surpaks I and II chest packets. For the extremity packets, these figures were 47 percent and 60 percent, respectively.

3. Field size. When comparing Surpak I measurements with the physical survey measurements for chest field size, 79 percent of the cases were in agreement;* for extremity field size, 68 percent of the pairs were in concurrence.

4. Roentgen output. In measuring Roentgen output in mR, Surpak I measurements and the TLD readings were in agreement in 47 percent of the chest exposures and 51 percent of the extremity exposures. For fluoroscopic exposure rate, 35 percent of the Surpak I and physical survey measurements were in agreement within 30 percent.

5. Target-to-panel top distance. In measuring fluoroscopic target-to-panel top distance, Surpak I and the physical survey were in agreement in 86 percent of the measurements.

6. Beam collimation. When compared with the physical survey, the efficiency of the Surpak in detecting the useful beam outside the limits of the fluorescent screen was calculated to be 96 percent.

It should be noted that there was a significantly higher correlation, in all categories compared, between the physical survey measurements and Surpak II measurements, than between Surpak I measurements and the physical survey measurements. This is accounted for by the fact that those persons who exposed Surpak II were thoroughly familiar with the Surpak design and instructions, and thus were more likely to correctly execute the Surpak exposure instructions.

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*Unless otherwise stated, "in agreement" is defined as the percentage of measurements within $\pm$ 20 percent of one another.

CONCLUSIONS

1. The basic theory and design of the Medical Surpak are sound. The Surpak, when properly exposed, can be used to measure X-ray beam size, fluoroscopic tube target-to-panel top distance and beam collimation and attenuation through the fluoroscopic screen. The Surpak can also be used to provide estimates of total filtration and half-value layer.

2. The Nevada and Mississippi field trials demonstrated that Surpak distribution and processing procedures were satisfactory. However, an excessive number of recipients failed to properly expose the Surpak components, indicating the need for simpler, more concise instructions, and improved labeling of components.

3. The Rhode Island trials were inconclusive in evaluating the reliability and accuracy of the Surpak, because of small sample size, difficulties in statistical design and failure of study planners to instruct the surveyors to measure certain key parameters during the physical survey. Any future studies should employ more stringent control of the factors mentioned above.

4. The present survey cost of approximately $20 per Surpak rules out routine distribution of this device. On-site surveys provide more information, of greater reliability, at less cost. However, the Surpak lends itself to use in controlled studies such as the National X-ray Exposure Study recently conducted by the Public Health Service.

5. The Surpak design and interpretation data should be made available to those individuals or agencies who may have need to use this device in the conduct of their radiation safety activities.

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(8) BARONE, G. J. Field trial of medical surpak in the State of Rhode Island, X-ray Exposure Control Laboratory Report No. P-021. Unpublished data (1965), Public Health Service, National Center for Radiological Health, 12720 Twinbrook Parkway, Rockville, Md. 20852.

APPENDICES

Appendix 1

GENERAL INSTRUCTIONS

These instructions and the materials in the accompanying box are for evaluating some important characteristics of your X-ray unit. The success of the evaluation depends upon the proper use of the materials and it is suggested that you read through the instructions before starting the evaluation. Attached to these instructions is a sheet for recording exposure data. Please record the appropriate data and enclose the sheet in the shipping box when returning the evaluation materials.

The materials are to be used on a single X-ray unit. Its characteristics are evaluated by substituting film packets for patients in standard examinations. Three film packets are enclosed; a chest packet, an extremity packet, and a fluoroscopic packet. Instructions for the assembly and use of each packet are identified by title on the attached sheets. Use only those packets which apply to your machine. For example, if you have a combination radiographic-fluoroscopic unit, use all three packets.

X-RAY FILM IS AN INTEGRAL PART OF ALL OF THE PACKETS AND IT IS IMPORTANT THAT ALL THE MATERIALS BE STORED IN A RADIATION FREE AREA. THE MATERIALS FOR A PARTICULAR PACKET SHOULD BE TAKEN INTO THE X-RAY ROOM ONLY AS NEEDED, AND THEY SHOULD BE RETURNED TO THE RADIATION FREE AREA BEFORE ASSEMBLING ANOTHER PACKET.

At the conclusion of the evaluation, repack all components, used and unused (including the completed data sheet), in the box. In the shipping container are two pieces of tape and a mailing label. Affix the pre-addressed mailing label to the outside of the box. Seal the box with the tape provided and mail. No postage is required.

CHEST PACKET

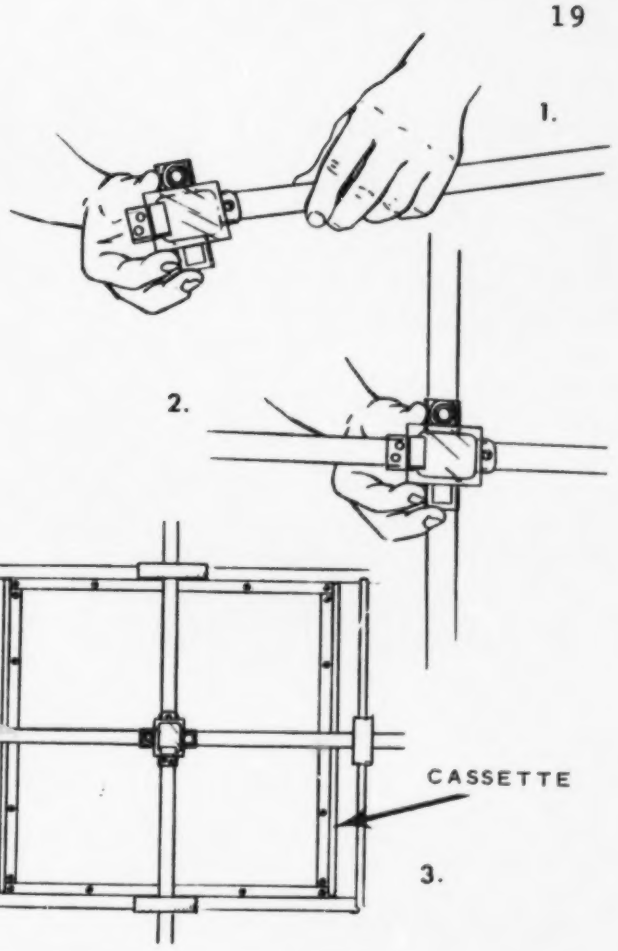
INSTRUCTIONS FOR ASSEMBLY AND USE OF CHEST PACKET
(THESE INSTRUCTIONS APPLY ONLY TO RADIOGRAPHIC PROCEDURES.)

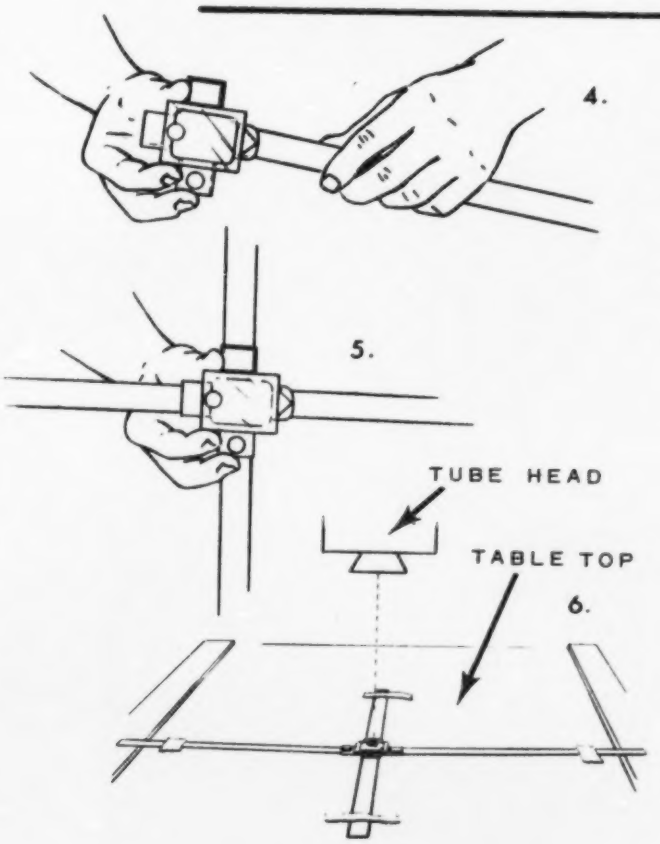
ASSEMBLY

1. TAKE THE RED PLASTIC ENVELOPE AND THE SMALL RED PLASTIC CROSS LABELED, "CHEST," INTO THE RADIOGRAPHIC ROOM.
2. REMOVE THE 48" STRIPS FROM THE RED PLASTIC ENVELOPE AND INSERT THEM INTO THE SMALL RED CROSS AS SHOWN IN FIGURE 1.
3. FORM FOUR ARMS OF EQUAL LENGTH, AS SHOWN IN FIGURE 2, BY PULLING STRIPS THROUGH CROSS.

USE

1. POSITION YOUR X-RAY UNIT AS YOU DO FOR CHEST RADIOGRAPHY AND PLACE AN EMPTY CASSETTE INTO CASSETTE HOLDER.
2. POSITION THE ASSEMBLED PACKET AGAINST THE CASSETTE HOLDER SO THAT THE METAL DEVICES ON THE RED PLASTIC CROSS FACE THE TUBE, THE RED PLASTIC CROSS IS POSITIONED IN THE CENTER OF THE CASSETTE, AND ONE ARM OF THE PACKET IS PERPENDICULAR TO THE FLOOR.
3. TAPE THE PACKET INTO POSITION AS SHOWN IN FIGURE 3, WITH THE TAPE PROVIDED ON THE RED PLASTIC ENVELOPE.
4. MAKE A SINGLE EXPOSURE WITH THE KVP, MA AND DISTANCE SETTINGS YOU USE FOR A 23 CENTIMETER THICK P.A. CHEST.
5. RECORD THE SETTINGS USED ON THE ATTACHED DATA SHEET.
6. CAREFULLY REMOVE TAPE AND DISASSEMBLE.
7. REINSERT STRIPS IN LONG RED ENVELOPE AND PLACE DISASSEMBLED CHEST PACKET IN SHIPPING CONTAINER.





EXTREMITY PACKET

INSTRUCTIONS FOR ASSEMBLY AND USE OF EXTREMITY PACKET
(THESE INSTRUCTIONS APPLY ONLY TO RADIOGRAPHIC PROCEDURES.)

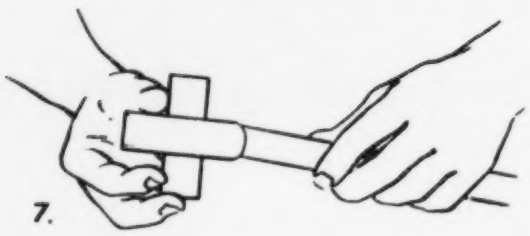
ASSEMBLY

1. TAKE THE WHITE PLASTIC ENVELOPE AND THE SMALL WHITE PLASTIC CROSS LABELED, "EXTREMITY" INTO THE RADIOGRAPHIC ROOM.
2. REMOVE THE TWO STRIPS FROM THE PLASTIC ENVELOPE AND INSERT THEM INTO THE SMALL WHITE CROSS AS SHOWN IN FIGURE 4.
3. FORM FOUR ARMS OF EQUAL LENGTH, AS SHOWN IN FIGURE 5, BY PULLING STRIPS THROUGH CROSS.

USE

1. POSITION YOUR X-RAY UNIT AS YOU DO FOR RADIOGRAPHY OF AN ADULT HAND.
2. PLACE THE ASSEMBLED PACKET ON THE PANEL OR TABLE TOP WHERE YOU WOULD NORMALLY PLACE THE FILM OR FILM CASSETTE SO THAT THE METAL DEVICES ON THE WHITE PLASTIC CROSS FACE THE TUBE AND THE CROSS IS CENTERED UNDER THE TUBE AS SHOWN IN FIGURE 6.
3. TAPE THE ASSEMBLED PACKET IN PLACE, IF NECESSARY, WITH THE TAPE ON THE BACK OF THE WHITE PLASTIC ENVELOPE.
4. MAKE A SINGLE EXPOSURE WITH THE KVP, MA, AND DISTANCE SETTINGS YOU USE FOR AN ADULT HAND.
5. RECORD THE SETTINGS USED ON THE ATTACHED DATA SHEET.
6. CAREFULLY REMOVE TAPE AND DISASSEMBLE.
7. REINSERT STRIPS IN LONG WHITE ENVELOPE AND PLACE DISASSEMBLED EXTREMITY PACKET IN SHIPPING CONTAINER.

FLUOROSCOPIC PACKET



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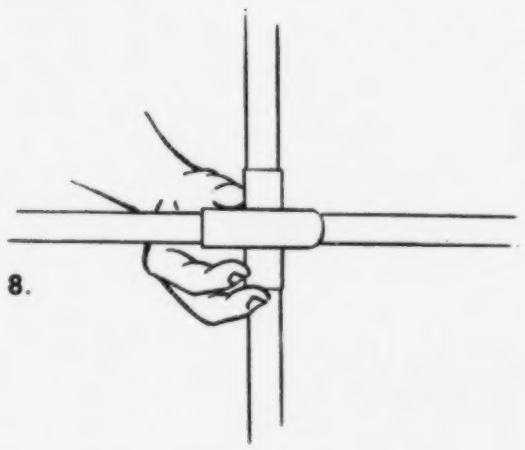

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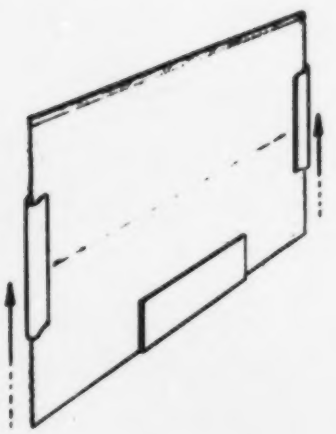

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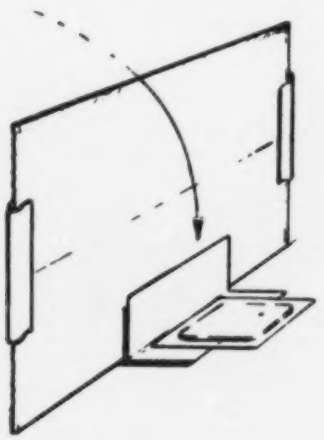

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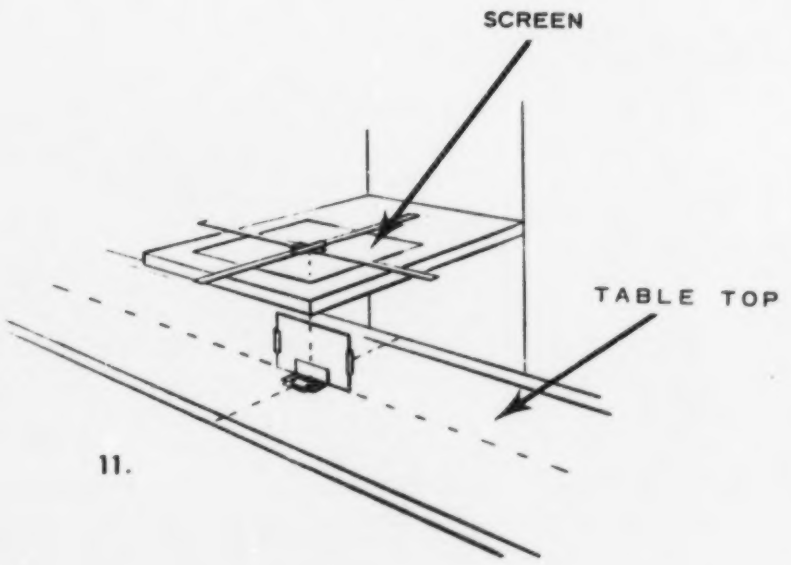

11.

INSTRUCTIONS FOR ASSEMBLY AND USE OF FLUOROSCOPIC PACKET

ASSEMBLY

1. TAKE THE LONG BLUE PLASTIC ENVELOPE, THE SMALL BLUE PLASTIC CROSS, THE METAL STAND, AND THE FOLDED 5 X 7 INCH FILM ENVELOPE (ALL LABELED, "FLUOROSCOPE") INTO THE FLUOROSCOPIC ROOM.
2. REMOVE THE TWO STRIPS FROM THE BLUE ENVELOPE AND INSERT THEM INTO THE SMALL BLUE CROSS AS SHOWN IN FIGURE 7.
3. FORM FOUR ARMS OF EQUAL LENGTH AS SHOWN IN FIGURE 8 BY PULLING STRIPS THROUGH CROSS AND SET ASIDE.
4. UNFOLD AND STRAIGHTEN THE 5 X 7 INCH FILM. SLIDE THE ATTACHED PLASTIC CLIPS MIDWAY OVER THE FOLD AS SHOWN IN FIGURE 9.
5. INSERT 5 X 7 INCH FILM INTO METAL STAND SUCH THAT THE STAND FULLY COVERS THE CARDBOARD ATTACHED TO THE EDGE OF THE FILM AS SHOWN IN FIGURE 10.

USE

1. TAPE THE FLAT PORTION OF THE METAL STAND AGAINST THE PANEL OR TABLE TOP SO THAT THE CENTER OF THE METAL STAND IS OVER THE MIDLINE OF THE PANEL OR TABLE TOP, AS SHOWN IN FIGURE 11.
2. POSITION THE FLUOROSCOPIC SCREEN 15 INCHES FROM PANEL OR TABLE TOP AND LOCK AT THIS HEIGHT.
3. POSITION THE CENTER OF THE SCREEN OVER THE CENTER OF THE METAL STAND AS SHOWN IN FIGURE 11.
4. OPEN FLUOROSCOPIC SHUTTERS TO MAXIMUM WIDTH.
5. PLACE THE BLUE PLASTIC CROSS ON TOP OF AND OVER THE CENTER OF THE FLUOROSCOPIC SCREEN SO THAT THE STRIPS ARE ORIENTED AS SHOWN IN FIGURE 11.
6. EXPOSE THE PACKETS FOR 15 SECONDS AT THE KVP AND MA SETTINGS YOU USE FOR A 21 CM. ABDOMEN.
7. RECORD THE SETTINGS YOU USED ON THE ATTACHED DATA SHEET.
8. CAREFULLY REMOVE TAPE AND DISASSEMBLE.
9. PLACE PLASTIC BLUE CROSS, STRIPS, 5 X 7 INCH FILM AND METAL STAND IN SHIPPING BOX.

Appendix 2

EXPOSURE DATA SHEET

PLEASE IDENTIFY THE X-RAY UNIT ON WHICH THIS SURVEY WAS PERFORMED.

1. MANUFACTURER, MODEL, AND SERIAL NUMBER OF CONTROL PANEL

MANUFACTURER_____

MODEL_____SERIAL_____

2. TYPE OF RADIOGRAPHIC COLLIMATION (CHECK WHERE APPROPRIATE)

( ) VARIABLE:

( ) CIRCULAR
( ) RECTANGULAR

( ) CONE:

( ) CIRCULAR
( ) RECTANGULAR

PLEASE RECORD THE MACHINE SETTINGS YOU USED IN EXPOSING EACH PACKET.

	CHEST PACKET	EXTREMITY PACKET	FLUOROSCOPIC PACKET
1. KILOVOLTAGE*	_____	_____	_____
2. MILLIAMPERAGE	_____	_____	_____
3. TIME (IN SECONDS)**	_____	_____	
4. MILLIAMPERE-SECONDS	_____	_____	
5. DISTANCE FROM TUBE TARGET TO CASSETTE	_____	_____	

*IF YOUR MACHINE DOES NOT INDICATE THE KILOVOLTAGE NUMERICALLY, RECORD HOW THE KILOVOLTAGE IS INDICATED, e.g., HIGH, MEDIUM, OR LOW, 1, 2, 3, ETC.

**IF YOUR MACHINE DOES NOT SEPARATELY INDICATE MILLIAMPERAGE AND TIME, INDICATE THE MILLIAMPERE-SECONDS

PLEASE RETURN THIS SHEET

Appendix 3

Dear

The Division of Radiological Health, State Board of Health, has maintained an inspection program of medical X-ray equipment, as required by

We feel at this time that a measurement for the degree of compliance to our state regulations must be made.

In the very near future, we will send you a Medical Surpak to expose with your medical X-ray machine. This Medical Surpak contains calibrated film which, when exposed according to the directions, will measure filtration, collimation, and Roentgen output of your machine.

As soon as you receive your Medical Surpak, please expose and return as directed, at your earliest convenience.

Sincerely,

State Health Officer

Dear

The State Board of Health sent you a letter notifying you of the distribution of Medical Surpaks for a compliance check of your medical X-ray equipment.

The attached carton contains the Medical Surpak, the instructions for proper assembly and exposure, an exposure data sheet, masking tape, tape to reseal the carton, and a self-addressed, postpaid mailing label.

Please be sure to read and follow the instructions for each type of exposure. When all exposures have been completed, and the data sheet is filled out, repack all components and the data sheet for return to us.

We would appreciate your immediate attention to this matter. If you have any questions concerning this Medical Surpak, please contact the Radiological Health Program, State Board of Health, at

Sincerely,

State Health Officer

Appendix 5

Dear

On , this office mailed you a Medical Surpak to be exposed by your X-ray machine(s). If you have not already done so, please expose this Surpak and return to this office.

These Medical Surpaks must be received in this office no later than for processing and evaluating.

If you are having difficulties interpreting the instructions, do not hesitate to contact the Radiological Health Program, State Board of Health, , Telephone number for clarification.

Sincerely,

State Health Officer

The ABSTRACT CARDS below are designed to facilitate document retrieval using Coordinate Indexing. They provide space for an accession number (to be filled in by the user), suggested key words, bibliographic information, and an abstract.

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MEDICAL SURPAK SUMMARY REPORT - X-ray Section; September 1968; MORP 68-4; XRS, MORP, NCRH, DHEW

Accession No.

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KEY WORDS:

X-ray, Survey, Field trial, Survey packet, Film, Dosimetry, Beam size, Roentgen output

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* U.S. GOVERNMENT PRINTING OFFICE : 1968 O—324-349

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